

## Zero Boil Off System for Cryogen Storage, Phase I

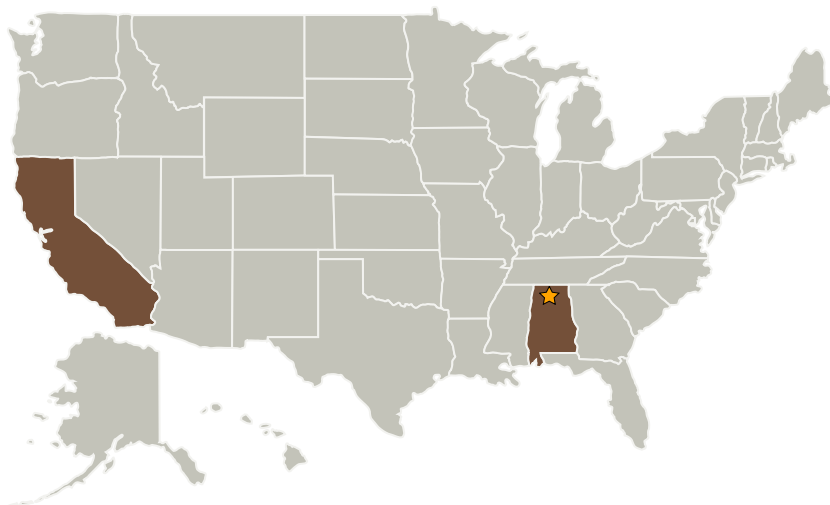
Completed Technology Project (2005 - 2005)



## Project Introduction

This work proposes to develop a zero boil off (ZBO) dewar using a two-stage pulse-tube cooler together with two innovative, continuous-flow cooling loops and an actively cooled shield. While a number of cryogenic refrigeration systems may be considered for such applications, none offers the same potential for low vibration, high reliability, and high efficiency as the pulse tube. The continuous-flow cooling loops are made possible by the presence of rectifying interfaces that convert the oscillating flow of the pulse-tube cryocooler into a steady flow of cold refrigerant gas that can readily be distributed throughout the volume of the dewar or over the surface of a shield, without need for a separate circulating pump.

## Primary U.S. Work Locations and Key Partners



| Organizations Performing Work         | Role                    | Type        | Location             |
|---------------------------------------|-------------------------|-------------|----------------------|
| ★ Marshall Space Flight Center (MSFC) | Lead Organization       | NASA Center | Huntsville, Alabama  |
| Atlas Scientific                      | Supporting Organization | Industry    | San Jose, California |



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## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Marshall Space Flight Center (MSFC)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

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## Primary U.S. Work Locations

Alabama

California

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

James Maddocks

## Technology Areas

### Primary:

- TX14 Thermal Management Systems
  - └ TX14.1 Cryogenic Systems
    - └ TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors